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Development and Validations of a Holistic Service Operations Management Instrument

Abg Hamizam Abg Mohar[a,*], Firdaus Abdullah[b], Voon Boo Ho[c]

[a, b, c] *Faculty of Business Management, Universiti Teknologi MARA (UiTM) Sarawak, Malaysia*

Abstract

Studies in manufacturing areas have empirically indicated that good operational practices have led to superior operational performances. However, these studies have been overshadowed by manufacturing based management practices rather than services. In service operations management studies, over emphasis is being placed on service quality which is based on the customer's perceptions and expectations. Thus, there is a need to re-evaluate the approach towards the understanding of service operations management as a mechanism in achieving competitive advantage. To fill the void, this study is carried out in a service setting and is seen from the perspective of the service operations manager. The approach used in the study is both qualitative and quantitative. The procedures employed revealed six factors that are critical for the establishment of a holistic service operations management. Correlations analyses showed relatively strong relationship within the factors. Further unidimensionality, reliability and validity analysis concluded that the factors model fit well and represents a reasonably close approximation in the population. The study offers a systematic approach framework for the empirical understanding of operations management in a service setting.

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1. Introduction

Like any organization, services provider has been seeking alternative means in the pursuit of growth and success. With the global business environment changing rapidly, further pressures has been put on service providers to adopt

* Corresponding author. Tel.: +6016-871-5456.
E-mail address: abanghamizam@sarawak.uitm.edu.my

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sustainable operational practices to achieve competitive advantage (Fred, 2011). Thus, to cope with changes, service providers have continually developed strategies to protect against threats and at the same time capitalizing on opportunities. Many studies have validated that effective operational practices will lead to superior operations performance (Won et al., 2007; Miyagawa and Yoshida, 2010), thus enabling organizations to compete effectively in the market place. Though, manufacturing management practices should naturally apply to services, its transferability to services however calls for an in depth study due to inherent discrepancies and contradictions between service and manufacturing organizations. As such service operations management warrant a different approach.

Operations capabilities are critical sources of sustainable competitive advantage used by organizations by leveraging their assets and practices towards achieving superior performance. It is an outcome of the interactions of operations management practices. Operations management is the management of value creating activities during the transformation of resources from the input through to final output stage. Heizer and Render (2011) identified ten decision areas that are critical in operations management. These include location, process and capacity design, inventory management, layout, quality management, product and services design, job design, supply chain management, scheduling and maintenance. According to Johnston and Clark (2012), service operations management is similar to manufacturing operations, however with one critical difference that is the role of customer which is a strategic source of variations in the service delivery process. Schmenner (1986) suggested the use of labor intensity and the consumer's interaction and service customization matrix to ascertain the character of the service delivery process and distinguished four categories of services: service factory, service shop, mass service and professional service. In a similar view, Chase and Tansik (1983) argued that service system can be categorized based on the degree of customer contact that is pure services, mixed services and quasi manufacturing. It is posited that a service system potential operating efficiency depends on the degree to which the customer is in direct contact with the service facility relative to the total service creation. This critical factor inherently limits efficiency due to the uncertainty element that is introduced during the delivery processes.

On a different platform, Roth and Menor (2003) proposed that service providers need to consider the strategic alignment of three elements: the targeted market and segments, service as a complex bundle of offerings, and the service delivery system design choices. The elements interaction influences the customer and in turn, the evoked customer response to the service delivery process. Thus, operations strategy perspective is needed to set the practical insights that will allow organizations to effectively deploy their resources in order to provide the right offerings to the right customers at the right times. There should not be any segregation of employees because employees should be treated as customers as well. Mabert and Showalter (1981) in clarifying their roles in a service system and their interactions as a service operations system identified a nine-level component: internal organization, external organization, technology, customers, front-line employees, support employees, product mix, service mix, and customer interface. To assess efficiency requires successful interactions of the systems highlighting the role of the customer in the service delivery system, which permeates all aspects of operations.

Though operations practices, have and could lead to operations performance, a relatively large number of efforts have ended up in failure, resulting in a waste of resources. Investments in operational activities are also costly and time consuming before any effect can be seen (Evan and Lindsay, 2005) and under such circumstances, service operations manager need to know the best approach to ensure the right investment to affect the optimum efficiency. This study is carried out in a service setting, focuses on the delivery processes and is seen from the perspective of the service manager, provides an opportunity to identify critical factors as well to ascertain the relationships between the factors of service operations management. The approach used to develop the instrument for this study is consistent with the procedures recommended by Churchill (1979) which has been widely used for a variety of applications including the development of measuring instruments (Tinsley and Tinsley, 1987).

2. Research design

The study has been on the basis of exhaustive review of literature- prescriptive, conceptual and empirical. Feedback was also gained from interviews with service operations managers in different service sectors in Malaysia. Managers from the hospitality, health services, airlines and higher learning have been selected for the interviews. Open ended questions pertaining to the practices of operations management of their respective organizations were asked. The primary purpose of the interviews is to assess the constructs that are poorly addressed in literature but are

prominent in the services industries (Hudson and Ozanne, 1988). The feedback from the interviews was subjected to thematic analysis to identify the main themes (Boyatzis, 1998). From the analysis, four general constructs are identified, that is, technological literacy of employees, total service delivery knowledge, flexible layout to accommodate fluctuations and the incorporation of technology within the operations management function.

Based on the literature review and the interviews, 65 items have been identified. The content validity of the items was assessed by experts who have good background in operations management research. The items were screened to identify duplicate items and potential sources of ambiguity. Several items were eliminated and a few changes were also made such as substitution of words and restructuring sentences, redrafting and rephrasing technical jargons, to ensure clarity and simplicity. The experts viewed that the questionnaire corresponded with the relevant issues and the final item pools have 57 items.

The drafted questionnaire consisted of four sections, namely introduction letter to the respondent, respondent's profile (Section A), questions (Section B) and questions with regards to organization's operations capability (Section C). The questions were worded in English and are presented randomly as statements in the questionnaire, with the same rating scale used throughout. The questions were measured on a five point Likert type scale that varied from 1 (strongly disagree) to 5 (strongly agree). Experts from the service industry as well as those from the academic in the same field were asked to comment on any perceived ambiguities, omissions or errors concerning the drafted questionnaire. The majority of the experts viewed that the drafted questionnaire corresponded with the relevant issues of service operations management. The list of hotels, private hospitals, and private higher learning institutions was obtained from the Malaysian Association of Hotel, Association of Private Hospital Malaysia and Ministry of Higher Learning of Malaysia. Finally, thirty airlines operations managers in different airports within Malaysia were targeted from the three major carriers - Malaysian Airlines, Air Asia and Malindo Air.

Prior to the actual survey, the drafted questionnaire was piloted on 250 respondents, and yielded a response rate of 40%. Purification of the scale began with the computation of the coefficient alpha (Cronbach, 1951) based on Churchill's recommendation. The value of 0.70 and above was adopted as a cut off for demonstrating internal consistency of new scales (Nunnally and Bernstein, 1978). Reliability coefficient for the variables was indexed at 0.85, which met the required prerequisite, demonstrating internal consistency and satisfactory reliability values in their original form. At this stage, no items were deleted as it might be part of the construct that might span across part of these factor domains (Ahire et al, 1996).

2.1. Multivariate test of normality

The multivariate test of normality which is a prerequisite for many inferential statistical techniques is also checked. This is due to the use of a relatively large number of items and thus, creating potentials distortions and bias more potent when the assumptions are violated, as well as the complexity of the analysis may mask the indicators of assumption violations apparent in a simpler univariate analysis (Hair et al., 2010). Any violation will result in unreliable inferences and misleading interpretations. The basic approach (Johnston and Wichern, 1992) for multivariate test of normality involves getting D2 for each subject, and plotting against the quantiles of the χ^2 distributions is employed. The scatter plots of chisq_q vs. di_sq indicates the good fit with $R^2 = 0.99$ implying that the data is multivariate normal.

Prior to factor analysis, a number of analyses were carried out to check on the factorability of the data, as suggested by Hair et al.,(2010). Inter items correlation were checked, and the visual checking of the correlation suggested that there were relatively high degrees of correlations, where significant numbers of correlations between items were well above 0.30. Bartlett test of sphericity, which provided the statistical probability that the correlation matrix has significant correlations among at least some of the variables, indicated that the results were significant, $p < 0.01$, χ^2 (57, N = 100). Kaiser-Meyer-Olkin (KMO), which measured the overall sampling adequacy, was also computed to quantify the degree of correlation between items. Based on Kaiser's (1970) categorization, KMO was indexed at 0.85, which was far above the adequate sampling requirement. The anti-image correlation was further checked to assess the sampling adequacy of individual items. Inspection of the matrix revealed that all individual items were well above the acceptable level of 0.5 that is between 0.60 to above 0.90. All these confirmed the suitability of the data for factor analysis.

Table 1. Results of factor analysis.

No	Items	Factors					
		1	2	3	4	5	6
1	Outsourcing	.743					
2	Readily available information	.687					
3	Standard operating procedures (SOP)	.636					
4	Equipment and facilities utilization	.603					
5	Maintenance by vendor	.530					
6	Interdepartment communication	.511					
7	Supplier relationship		.858				
8	Top management commitment		.674				
9	Job design		.644				
10	Quality improvement initiatives		.628				
11	Work areas are facilities equipped		.520				
12	Sufficient resources for employee development			.668			
13	Technology applications in managing inventory			.600			
14	Service delivery checklist			.535			
15	Application of service design tools			.520			
16	Use of statistical charts			.502			
17	Employee training				.765		
18	Supplier certification				.591		
19	Online booking and purchasing				.543		
20	Supplier rating				.514		
21	Safe layouts					.681	
22	Application of technology in service delivery					.627	
23	Employees suggestions					.626	
24	Application of technology in scheduling					.552	
25	Technologically self service kiosks					.531	
26	Customers requirement incorporation during service design stage						.793
27	Benchmarking						.595
28	Process flowcharts						.589
29	Designing service using technology applications						.588
30	Service process improvement programs						.522
Eigenvalues		14.44	2.67	2.11	1.21	1.11	1.08
Percentage of Variance		45.11	8.34	6.60	3.77	3.46	3.38
Cumulative Percentage of Variance		45.11	53.45	60.05	63.82	67.28	70.66

Principal axis factoring was used in the analysis and latent root criterion was applied for factor extraction. The decision to include items in a factor was based on factor loadings greater than 0.5 (Hair et al., 2010) and all factors whose eigenvalues greater than 1.0 was retained in the factor solution (Tabachnick and Fidell, 2001). The communality of each variable was also checked to identify items that are not adequately accounted for by factor solution. Items having low communalities of less than 0.5 were considered as not having sufficient explanation (Hair et al., 2010). In achieving a well defined factor structure, some items were removed from the factor loading matrix, resulting in a reduction of number of factors as some factors have become meaningless since some of the items that

were initially assigned to those factors had no longer exist and the remaining items have near to zero correlation between themselves and the assignments of some items. Subsequently, the EFA procedure revealed six factors that accounted for 70.7% of the variation in the data. Table 1 shows the final results of the factor analysis in terms of factor name, the variables loading on each factor, the eigenvalues, percentage variance and cumulative percentages variance explained by each factor.

2.2. Confirmatory Factor Analysis (CFA)

A highly critical condition for construct validity and reliability checking is the unidimensionality of the measure, implying the existence of a single construct or trait underlying a set of measures (Hattie, 1985; Anderson and Gerbing, 1991). In order to check for unidimensionality, Lisrel 8.3 was used to confirm how closely the six factors represent the same construct. Multiple fit indices were considered simultaneously. Table 2 shows the factors fit indices of the data. The Chi-square for the data is $\chi^2 = 784.96$, df = 441, and the relative likelihood ratio between χ^2 and its degrees of freedom (χ^2/df) was indexed at 1.80 which was considered a good fit. RMSEA and SRMR were indexed at 0.06 and fell within an acceptable fit. Normed Fit Index (NFI) and Non Normed Fit Index (NNFI) were indexed at 0.91 and 0.96 respectively. The value of CFI in this model was indexed at 0.96. These indices were well in a category of an acceptable fit. Hair et al.,(2010) further suggested that for a model to be accepted as a good model, based on the number of observation ($N < 250$) and with number of observed variables ($N \geq 30$) recommended that χ^2 be significant, with CFI of more than 0.92, SRMR less than 0.09 and RMSEA less than 0.08. The six factors indices were clearly well within the recommended range and therefore it can be concluded that the model fit well and represents a reasonably close approximation in the population.

Table 2. Six factors fit indices.

No.	Fit Indices	Indices
1	Chi square	Chi sq : 784.96, df : 441
2	Relative Chi Square (X^2/df)	1.80
3	Root Mean Square Error of Estimation (RMSEA)	0.06
4	Standardized Root Mean Square Residual (SRMR)	0.06
5	Normed Fit Index (NFI)	0.91
6	Non Normed Fit Index (NNFI)	0.96
7	Comparative Fit Index (CFI)	0.96

Further reliability test was carried out after the unidimensionality has been established. The coefficients for all the factors are shown in Table 3. All the values meet the required prerequisite, thereby demonstrating that all the factors are internally consistent and have satisfactory reliability values in their original form.

Face validity was assessed qualitatively by operationalized constructs as to present unambiguous meaning of the subject being studied whereas content validity emphasized on the relevancy of the content domains exist in the relevant literature against the constructs of measurement. Since the questionnaire had been designed through a comprehensive exercise (through review of relevant literature, inputs from experts from service industries and fined-tuned them), therefore both the face and content validity of the instrument were ensured (Bohrnstedt et al., 1983; Kaplan and Saccuzzo, 1993). Table 3 also shows the Bentler Bonnet indices of the respective factors. The coefficient values range well above 0.90 indicating evidence of convergent validity. Discriminant validity is the extent to which the factor is truly distinct from other factors, providing the evident of uniqueness, which capture some phenomena, that other constructs do not (Hair et al., 2010). A Chi-square (χ^2) difference test is adopted for the purpose. The discriminant validity of the two factors is the difference between the χ^2 values of the restricted model and unrestricted model, where the degree of freedom (*df*) is less than one for each additional path that was estimated. A statistical significant value of χ^2 difference demonstrates that the two factors are distinct. In the study, the procedure was repeated for all the pairs resulting in a total of 15 discriminant validity checks. The entire

procedures indexed χ^2 differences statistically significant at $p < 0.005$, indicating discriminant validity. Criterion-related validity refers to the extent to which one measure estimates or predicts the values of another measure. Criterion-related validity is established by correlating the dimensions scores with operations capability. Table 4 indicates that all the factors show positive correlations with operations capability. Hence, criterion-related validity is established for all the factors. The study confirmed that there is a relatively strong relationship between the six factors The correlation between all the factors indicates a relatively a strong relationship which ranges well above 0.500 to 0.878, with the exception of factor 6 and factor 5 which is correlated at 0.380. All correlations are statistically significant with $p < 0.001$. Such correlations imply that the six factors being a dynamic model through which the interactions of these factors as a total effect of the attainment of organization's operations capability.

Table 3. Cronbach Alpha and Bentler Bonnet Indices.

No.	Factors	Cronbach Alpha (α)	Bentler Bonnet Indices
1	Equipment management	0.90	0.91
2	Human initiatives	0.87	0.96
3	Service delivery control (SDC)	0.94	0.96
4	Certifications	0.89	0.98
5	Technology usage	0.76	0.94
6	Service delivery design (SDD)	0.86	0.93

Table 4. Correlation matrix : Six factors and operations capability.

Factors	Operations Capability
Equipment management	0.361
Human initiatives	0.455
Service delivery control (SDC)	0.370
Certifications	0.369
Technology usage	0.299
Service delivery design (SDD)	0.356

Note : All correlations were statistically significant ($p < 0.01$).

3. Discussion and conclusion

A strong and positive relationship between dimensions implies it being a dynamic model through which the interaction of these dimensions as a total effect the attainment of operations capability. This finding supports the notion that service operations management interact as a system as suggested by Mabert and Showalter (1981) and Roth and Menor (2003). The empirical findings shed light on some significant insights on service operations management. The six factors differentiate it from the manufacturing operations management dimensions. This supports the suggestion by Slack et al., (2004) which posited that operations management theories that have been strongly influenced by manufacturing management practices, have poorly reflected the service industries and subsequently have distorted the development of service operations management. As such the finding reflects the departure to a more service oriented operations management.

Technology usage such as communication technologies and its applications support safe layout features, employee feedback and self service kiosk, has acted as an 'interactive catalyst' towards integrating and facilitating exchange of information, facilitating vertical and horizontal integrations within different service delivery areas (Chathoth, 2007; Heim and Peng, 2010) which simultaneously accommodating customer's participation in the process. Better technology usage and applications in the delivery system has also acted as a platform to ensure effective equipment management. With outsourcing strategies, readily available information, communication technologies and SOP in place has allowed effective equipment management and simultaneously allowing access by

customer and employee to perform sophisticated processes, preventing service failures (Chase and Stewart, 1994), accommodating flexibility and in service delivery while supporting customer's participation.

The findings confirm the importance of human related factors within the service delivery system (Forza and Filippini, 1998; Tsai, 2006; Senaji and Nyaboga, 2011) as a strategy to response to service operational requirements and problems which are dynamic in nature. Better supplier relationship, committed top management and effective job design complemented by work areas that are equipped with facilities will enhance performance of the service delivery process and allow access to a higher level of operations capability (Lollar et al., 2010). Service delivery design factor is associated with the capacity of the service provider in ensuring service process delivery efficiency. Through benchmarking, use of process flowcharts, technology applications, incorporation of customer requirement and subsequently, improvement programs will assist the service provider in delivering the expected level of service efficiently. Service delivery control (SDC) characterized by the use of technology, checklists, service design tools and statistical tools refers to the need to monitor and control variation within the service delivery. Service delivery control is a preventive approach in process management by designing processes that are fool proof (Evan and Lindsay, 2005), resulting in output uniformity as well as reduced rework and waste (Ahire and Dreyfus, 2000). Statistical tools and techniques play an important role in monitoring and controlling operations processes and form an integral component of process management (Benner and Tushman, 2003). Certifications are associated with supplier certifications, supplier rating, employee level of training and online booking and purchasing. Certification induces supplier development program which involves long term cooperative efforts between the organization and its suppliers with the objectives to enhance suppliers' technical, quality, delivery, and cost capabilities and to process improvement. Such mutual beneficial relationship will help both organizations to compete more effectively in the marketplace whilst offering capacity stability.

As business operations become more globalized, new opportunities and threats may emerge, thus the knowledge of understanding specific dimensions roles in operations management play a pivotal role in ensuring operations success in the highly competitive market scenario. A holistic approach in service operations management provides a basis for further empirical works in the area of service operations management.

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